Bull. Inst. Oceanogr. & Fish., ARE, 13 (1), 1987: 151 - 160.

EFFECT OF AERATION REGIME ON MASS PRODUCTION OF *Moina micrura* KURZ.

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ABSTRACT

In aquaculture, aeration of the container is necessary to avoid depletion of dissolved oxygen and mass mortality of the culture, especially during night. Different aeration regimes, continuous or interrupted (by day or by night) were tried. The effects of the aeration regime on temperature, dissolved oxygen, phytoplankton standing crop and mass production of **Moina micrura** were followed daily for a month.

INTRODUCTION

A great demand exists in aquaculture for live zooplankton of suitable size for feeding crustacean and fish larvae. Cladocera and Rotifera are an excellent food source for rearing fish fry. So far, no dry diet was found as successful as feeding on living food organisms (Imai, 1977 and Heisig, 1979).

Agostino and provasoli (1970, in Mandy et al., 1977) demonstrated that **Daphnia magna** could be grown axenically for at least 200 generations and the cultures were stable and supplied abundant progeny of known age, genetic homogenity and vigour.

Mass culture of **Dephnia lumholtzi** Sars was successfully achieved by Nandy et al., (loc. cit) by using poultry manure as the source of nutrient and supplementing with the unicellular alga **Chlorella vulgaris** as food. The population of **D. lumholtzi** reached a peak in 7 days.

In this work, the experimental tanks were manured with a mixture of organic and inorganic fertilizers which enhance phytoplankton blooms, followed by an outburst of zooplankton, amongest which **Moina micrura** dominates for sometime. The different tanks were aerated for different durations, or left without aeration. The effect of aeration on temperature, dissolved oxygen, phytoplankton standing crop and biomass production of **M. micrura** were studied to assess the possibilities of conserving energy (in aerating) during a specified time of the day or night.

MATERIAL AND METHODS

a. Period of Observations :

One month from 13 May to 13 June 1983.

b. Culture Tanks and Aeration Regime :

Four cement cylindrical tanks having a capacity of 300 L were used. In tank No. 1 aeration was continuous by day and night. In tank No. 2, it was interrupted during night, and in tank No. 3, during day. Tank No. 4 served as control without aeration. Aeration was provided with a single air tube fitted with an air stone to reduce the bubble size. The source of aeration was an air blower/compressor and the rate of bubbling was kept uniform and constant in the aerated tanks.

c. Fertilizers :

Organic liquid manure is usually obtained from the aerobic fermentation of animal manure in biogas plants or by mixing fresh manure with water (Medina, 1979). In this experiment, liquid manure has been prepared in a tank by dissolving 10 Kg raw cattle dung, 10 Kg ground nut oil cake, 2 Kg single superphosphate and 600 g urea in 300 L of water. The mixture was kept under vigorous agitation by providing an aeration point.

d. Inoculation :

Moina micrura was collected from a 20 m^3 zooplankton culture cistern in which the species was dominant. It was inoculated in the four culture tanks on the 3^{rd} day after manuring, at the rate of 50 individual per litre of tank water.

e. Physico-Chemical and Biological Observations :

Temperature was recorded by a thermometer graduated to 0.5 °C. Dissolved oxygen was determined according to Winkler's method. Phytoplankton density was measured by the sedimentation method, using Lugol's solution as preservative. One ml. counting chamber divided in 950 squares was used and the counting repeated twice. **Moina micrura** was collected by filtering 3 litre through a plankton net, and counting was done by using a 5 ml Rafter cell.

RESULTS

a. Temperature :

In general, water temperature in the tanks followed air temperature. During the day, water temperature in tank 1 was 27-29.5°C in the morning

(6 a.m.), 32-35°C in the after noon (1-3 p.m.) and 31-33°C in the evening (7 p.m.). In the morning, all tanks were at nearly the same temperature except for tank 1 which may be cooler than the others by about 0.5°C. On the other hand the surface temperature in tank 4 was always higher by about 1-1.5°C than that of tank 1, especially from mid-day till evening. Tanks 2 and 3 were intermediate (table 1 and fig. 1). This leads to the conclusion that aeration has some cooling effect on tank water.

b. Dissolved Oxygen :

Dissolved oxygen was measured 3 times a day, at about 6 a.m., 1-3 p.m. and 7 p.m. For the study of diurnal variation, it was analysed every 1-2 hours until late in the evening. The results show that there is an increase in dissolved oxygen from day-break at 6 a.m. to a maximum usually from 1 to 3 p.m. (fig. 2). But sometimes the maximum is reached at any time from 11 a.m. to 7 p.m. As light begins to deminish, dissolved oxygen decreases to a minimum, or to complete depletion, at the end of night (fig. 3 a and b and table 2). Maximum values for dissolved oxygen were usually observed in tank No. 3, up to 248.8 % (aerated by night). Tank No. 1 which was continuously aerated day and night, did not reach more than 195.2 %. The phytoplankton in this latter tank however, was maximal in density, while in tank No. 3, its density was much lower during the whole period. It is obvious that aeration lowers the level of supersaturation by agitation. On the other hand, oxygen can be dissolved by aeration when the initial DO content of the waters is low (e.g. tank 2 at 6 a.m., compared to the others). It also shows that aeration by night is more effective in preventing depletion, but phytoplankton density is increased with uninterrupted aeration.

c. Phytoplankton (fig. 4) :

The blooms in the four tanks vary both in magnitude and in timing. The standing crop reached a maximum of 331000 cells/ml in tank No. 1 eleven days after the beginning of the experiment, while the bloom in tank 3 reached only 5300 cells/ml. after 20 days, and in tanks No. 2 and No. 4, 4700 and 1700 cells/ml respectively. Such differences may be due to the differences in the aeration and agitation regime. The most common species were **Scenedesmus quedricauda, Pediastrum** boryanum and **Cosmarium granatum.**

d. Moina micrura :

The higher productivity in tank 1, provided with uninterrupted aeration lead to the increase in **M. micrura** density up to 1550 ind./l. In the non-aerated tank No. 4 the densities were always low and did not exceed 1120 ind/l. In tanks No. 2 (day aeration) and No. 3 (night aeration) the maximum densities were nearly equal (1280 and 1250 ind/1). The latter tanks were intermediate between tanks 1 and 4 (fig. 4).

TABLE (1)

Temperature fluctuation in experimental tanks 1-4 Minimum & Maximum.

	Air Temperature	Water temperature °C Tank 1	Tank 4	Tank 2	Tank 3	
Morning	Min.	25.5	27	27.5	27.5	27.5
6 a.m.	Max.	29	29.5	29.5	29.5	29.5
	Min.	28	32	32	32	32
1 - 3 p.m.	Max.	32	35.5	36.5	35.8	35.8
	Min.	27.5	31	31	31	31
Evening	Max.	29.5	33	34	33.5	34

TABLE (2)

Maximum and minimum oxygen percentage saturation, at different times of the day in the 4 tanks.

	Tank 1		Tank 2		Tank 3		Tank 4	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
6 a.m.	93.2	6.4	134.2	0	99.3	31.1	92.4	21.8
1-3 p.m.	195.2	57	166.1	49.1	207	48.1	23[illegible].1	70.4
6.30-7p.m.	115.4	20.3	220.5	33.2	248.8	41.6	182.2	69.7

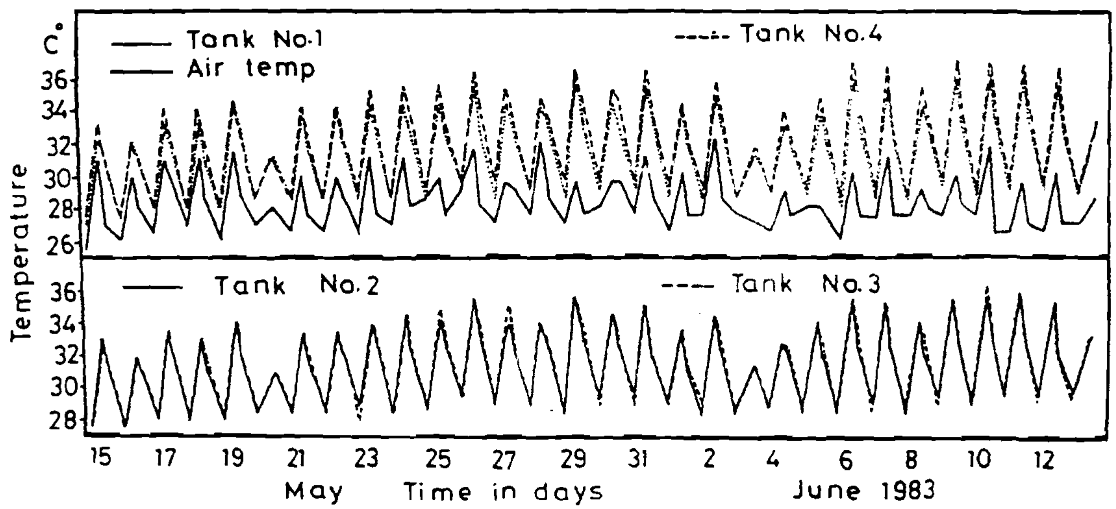

Fig. (1)
Daily variations of air water temperature in the 4 tanks.
Tank 1 - Continuously aerated, tank 2- aerated by day, tank 3- aerated by night and tank 4- without aeration, (measured at 6 a.m., 1-3 p.m. and 7 p.m.).

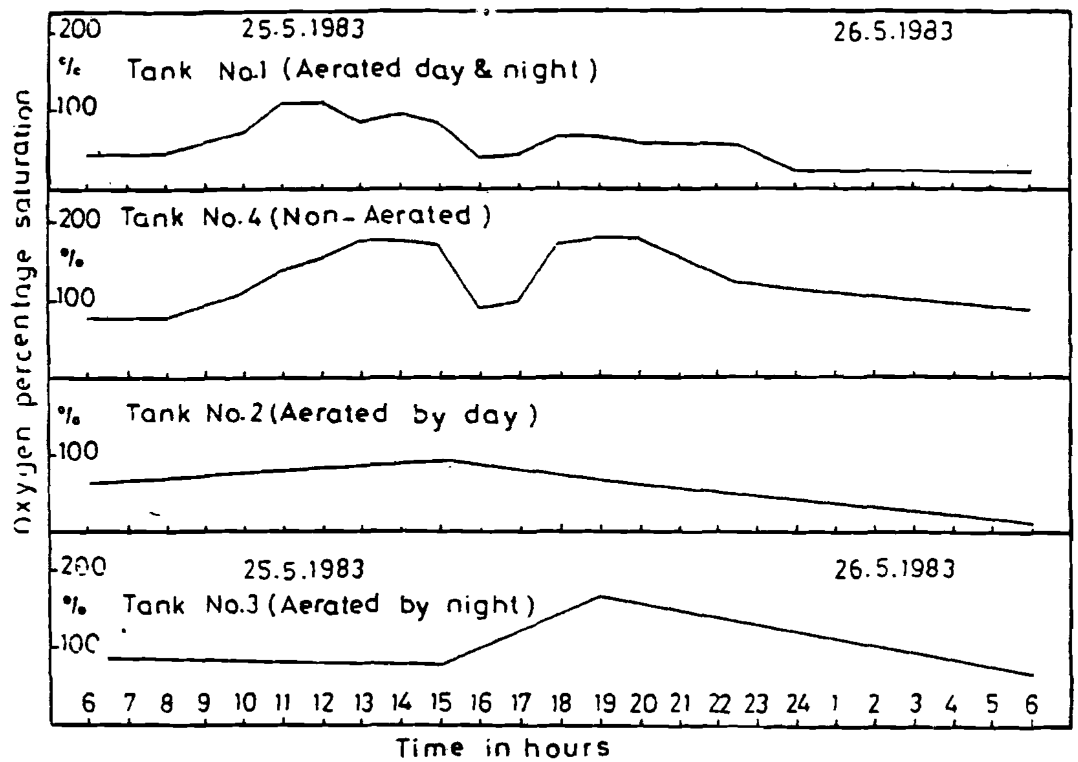

Fig. (2)
Diurnal variations of the percentage of dissolved oxygen saturation in the 4 tanks over 24 hours (6 a.m., 25.5.1983 to 6 a.m., 26.5.1983).

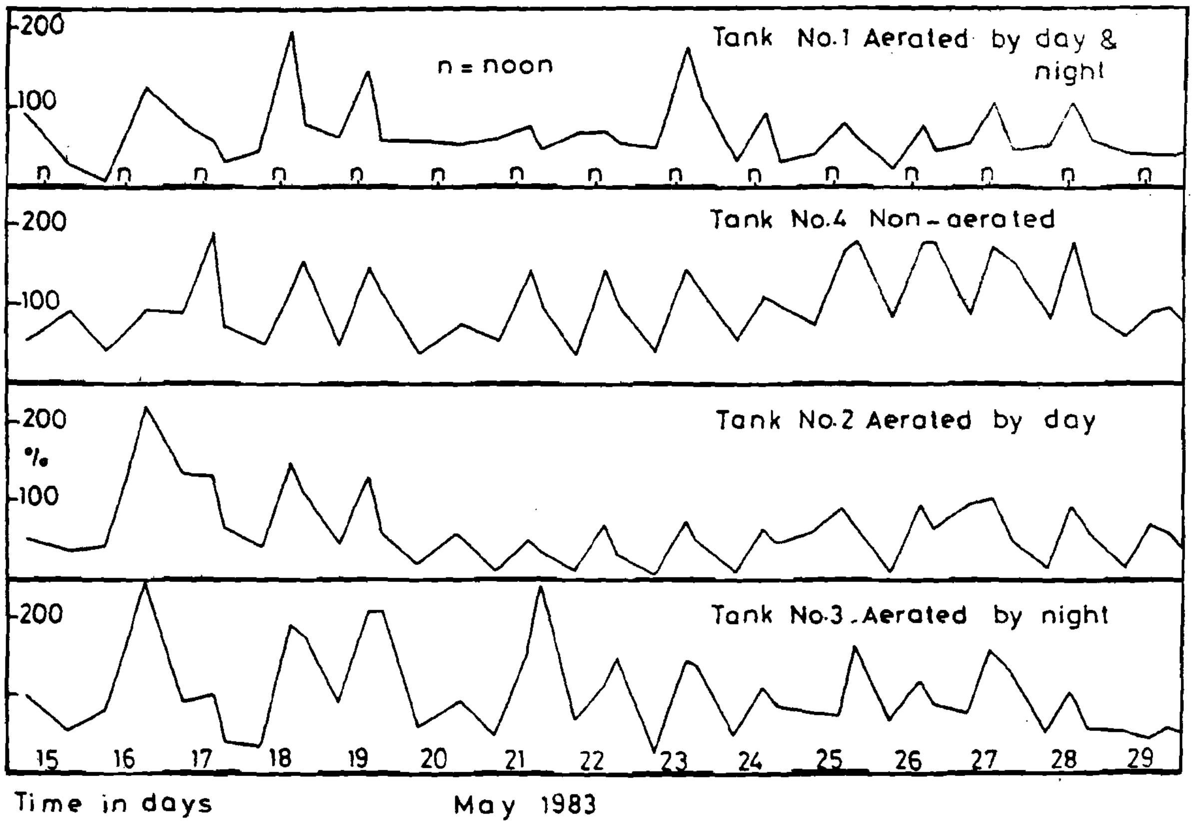

Fig. (3, a)
Daily variations of relative oxygen saturation (measured daily at 6 a.m., 1 - 3 p.m. and 7 p.m.)
from 15 to 29 May, 1983.

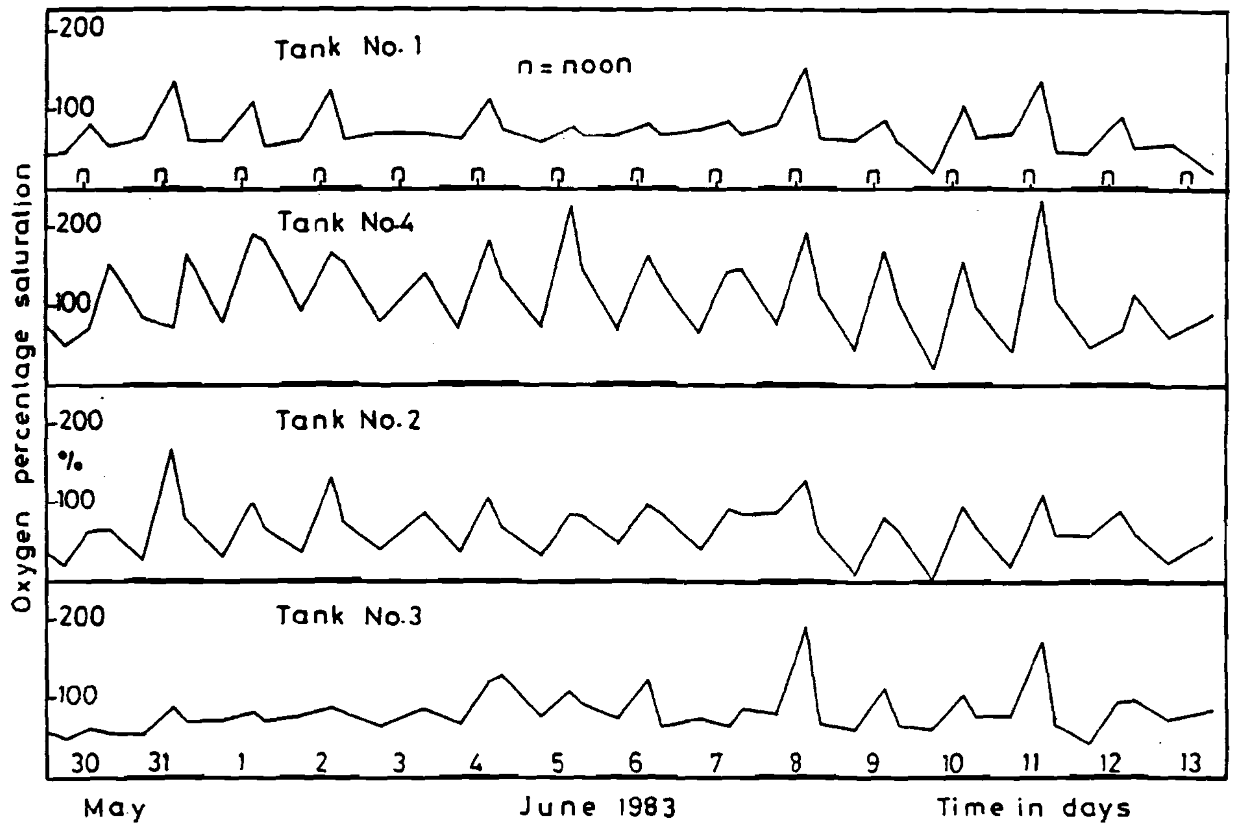

Fig. (3, b)
Daily variations of relative oxygen saturation from 30 May to 13 June, 1983.

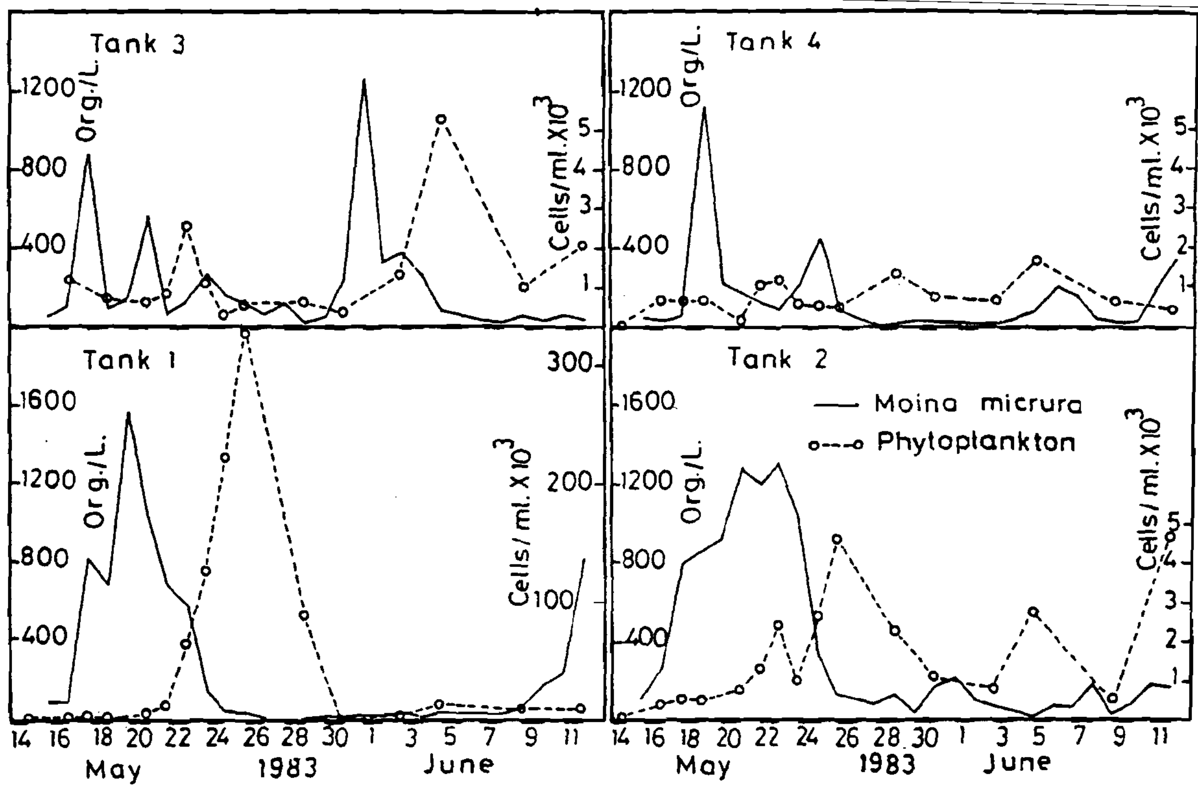

Fig. (4)
Daily variations of the phytoplankton standing crop (cell / 1) and the populations density of **Moina micrura** during the period of observations in the 4 tanks.

This leads to the conclusion that uninterrupted aeration raises the phytoplankton productivity in the tank water, and in consequence, increases the population density of the zooplankton.

ACKNOWLEDGEMENT

The author wishes to express his gratitude to Prof. Dr. Y. Halim, Department of Oceanography, Faculty of Science, Alexandria University for reviewing the manuscript. He also expresses his thanks to the staff of the Central Institute of Fisheries Education, Bombay, India for all the facilities provided especially to Prof. Dr. S.N. Dwivedi, the Director, for suggesting the problem, and to Mr. Mohiuddin for assistance in the laboratory work, and for counting some of the phytoplankton samples and also to Mr. S.K.R. Ansari for laboratory help.

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